Unit 11 Day 8 Notes on Mutually Exclusive vs Inclusive   **KEY**
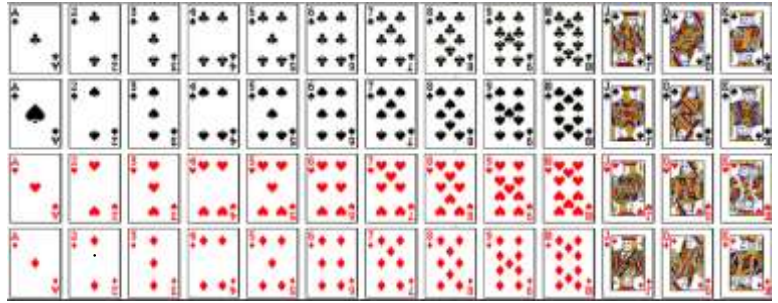
NO OVERLAP / MUTUALLY EXCLUSIVE

- Find the probability of selecting a diamond OR a heart.

$$\frac{13}{52} + \frac{13}{52} = \frac{26}{52} = \boxed{\frac{1}{2}}$$

- Find the probability of selecting a diamond or a King. OVERLAP / INCLUSIVE

$$\frac{13}{52} + \frac{4}{52} - \frac{1}{52} = \frac{16}{52} = \boxed{\frac{4}{13}}$$

Finding the probability of multiple events that are **mutually exclusive:**

Means: Two events ___**cannot**___ occur at the same time.

Examples:
1. Picking a card that is a two **_or_** an ace … in other words, a card can't be both a two and an ace at the same time.
2. Choosing a soda that is diet **_or_** regular … the soda can't be diet and regular at the same time.

If two events, A and B, are mutually exclusive, then the probability that either A **_or_** B occurs is found by:
P(A or B) = P(A) + P(B).

Let's Try It! ✱ always check to make sure it's even possible

1. Peyton has a stack of 8 baseball cards, 5 basketball cards, and 6 soccer cards. If she selects a card at random from the stack, what is the probability that it is a baseball **_or_** a soccer card? Mutually exclusive

$$\frac{8}{19} + \frac{6}{19} = \boxed{\frac{14}{19}}$$

2. A die is rolled. Find each probability.

   a. P(5 or 6)

$$\frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \boxed{\frac{1}{3}}$$

   b. P(at least a 3)   3 or 4 or 5 or 6

$$\frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{4}{6} = \boxed{\frac{2}{3}}$$

   c. P(less than 4)   1 or 2 or 3

$$\frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{3}{6} = \boxed{\frac{1}{2}}$$

3. From a standard deck of cards, what is the probability of a card being a King AND an Ace?

can't be both!

$$\boxed{0}$$

4. From a standard deck of cards, what is the probability of a card being a King OR an Ace? Mutually exclusive

$$\frac{4}{52} + \frac{4}{52} = \frac{8}{52} = \boxed{\frac{2}{13}}$$

Inclusive Events: When two events are *not* mutually exclusive, they are *inclusive.*

Examples:
1. Selecting a card from a deck that is either a queen or a diamond … in other words, the card could be both a queen **and** a diamond at the same time

2. Selecting a pair of pants that is either striped or made of cotton … the pants could be striped **and** made of cotton.

If two events, A and B, are **inclusive**, then the probability that A or B occurs is:

P(A) + P(B) – P(A and B)

$\underbrace{}$

OVERLAP

Try It!
1. What is the probability of drawing a queen OR a diamond from a standard deck of cards? INCLUSIVE

$$\frac{4}{52} + \frac{13}{52} - \frac{1}{52} = \frac{16}{52} = \boxed{\frac{4}{13}}$$

Queen of diamonds

2. What is the probability of drawing a queen AND a diamond from a standard deck of cards?

How many cards both a queen and a diamond?

$$\boxed{\frac{1}{52}}$$

3. 16 people study French, 21 study Spanish and there are 30 students in all. Is this a case of mutually exclusive or inclusive and why? __Inclusive – could take both classes__

Complete the Venn diagram and answer the questions below.

F = 16 − X   S = 21 − X

X

(9) (7) (14)
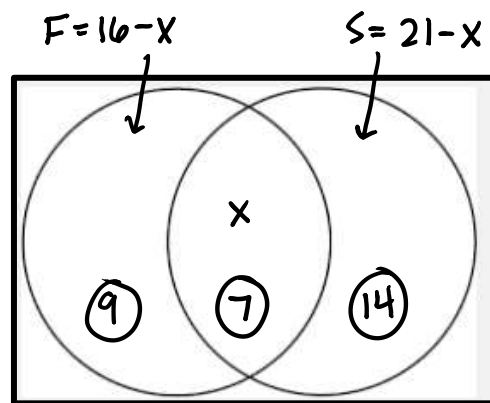
a. How many students studied both? __7__

b. How many students studied French only? __9__

c. How many students studied Spanish only? __14__

d. How many students studied French AND Spanish? __7__

X = students taking both

e. How many students studied French only OR Spanish only? __23__
9 + 14

16 − X + X + 21 − X = 30
−X = −7
X = 7

f. Find the probability that you select a student who students French AND Spanish. __7/30__

g. Find the probability that you select a student who studies French only OR Spanish only. __23/30__

$$\frac{9}{30} + \frac{14}{30}$$

Partner Practice!

"can't happen at the same time"

1. *Multiple Choice.* Which of the following pairs of events is *mutually exclusive*?

   A) Cards: Ace and Spades $\qquad\qquad$ B) Two dice: Odd and Even

   C) Sit down and Stand Up $\qquad\qquad$ D) Sit down and scratch your nose

2. A card is chosen at random from a pack of 52 playing cards. What is the probability of a King or a Queen?

   NO OVERLAP

   $$\frac{4}{52} + \frac{4}{52} = \frac{8}{52} = \boxed{\frac{2}{13}}$$

3. A card is chosen at random from a pack of 52 playing cards. What is the probability of a King or a Heart?

   OVERLAP

 $$\frac{4}{52} + \frac{13}{52} - \frac{1}{52} = \frac{16}{52} = \boxed{\frac{4}{13}}$$

4. There are 30 children in a class and they all have at least one cat or dog. 14 children have a cat. 19 children have a dog. What is the probability that a child chosen at random from the class has both a cat and a dog?

   14-x $\qquad$ 19-x

   $14-x+x+19-x=30$

   $-x=-3$
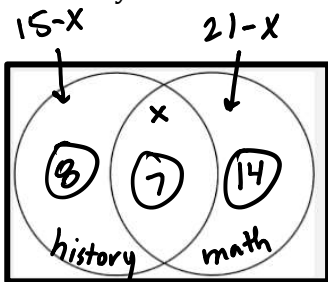
   $x=3$
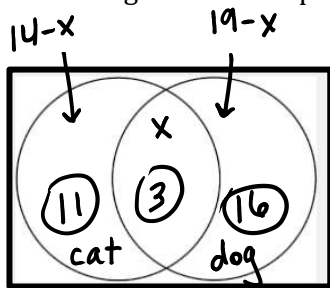
   $$\frac{3}{30} = \boxed{\frac{1}{10}}$$

5. In a group of 25 boys, 20 play ice hockey and 17 play baseball. They all play at least one of the games. What is the probability that a boy chosen at random from the class plays ice hockey but NOT baseball?

   20-x $\qquad$ 17-x

   $20-x+x+17-x=25$

   $-x=-12$

   $x=12$
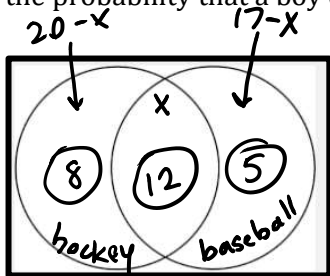
   $$\boxed{\frac{8}{25}}$$

6. In a class of 29 children, 15 like history and 21 like math. They all like at least one of the subjects. What is the probability that a child chosen from the class likes math only?

   15-x $\qquad$ 21-x

   $15-x+x+21-x=29$

   $-x=-7$

   $x=7$

   $$\boxed{\frac{14}{29}}$$